

## **PISTON MACHINE**

### Technical Field

The invention relates to a field of machine building and can be used in compressors, pumps and internal combustion engines.

### Prior Art

A piston machine is known, which has a crankcase with a cylinder fixed on it, in which a piston with a piston rod is located, and cover arranged on the cylinder. A link lever system with a cross head is connected with a crankshaft and has a guide in a lower part of the crankcase (Inventor's Certificate of USSR no. 905499, FO1B9/00 1978).

A disadvantage of the known piston machine is that it does not solve problems of reduction of a waste space that reduces its volume productivity, reducing of hydraulic losses in valves, and also insufficient cooling of the piston of the machine.

A piston machine is known, which has a crankcase with a cylinder fixed on it, in which a piston with a piston rod is located, and a cover arranged on the cylinder, suction and pumping valves, two parallel crankshafts located symmetrically relative to an axis of the cylinder and

connected with each other with a possibility of rotation in opposite direction, a traverse connected to the piston rod of the piston, two connecting rods each of which is connected with its end hingedly with a corresponding crankshaft, and with another end hingedly with a corresponding end of the traverse, while the piston rod of the piston is connected with the traverse hingedly. The machine is provided with a mechanism of turning of the connecting rods relative to the traverse over different angles. The known piston machine can be configured in a variant of a compressor, a pump or an internal combustion engine (Inventor's Certificate of the USSR no. 1224415, FO 1B9/02, FO2B 75/32, 1996, the closes analog).

A disadvantage of the known piston machine during its use as a compressor is the presence of a significant waste space and significant hydraulic losses during suction and pumping of a working body due to the location on one cover of the cylinder of suction and pumping valves, increasing a minimal volume between the cover and the piston due to the volume of the valves and reducing areas of flow cross-sections both of suction valves and pumping valves which occupy together the same surface of the cover, which reduces a volume productivity of the piston machine and filling of the cylinder with the working body. Moreover, in the piston machine a sufficient cooling of the piston is not provided.

### Summary of the Invention

A task which is solved in the invention is a creation of a piston machine which provides a reduction of volume of waste space, a reduction of hydraulic losses during suction and pumping, and a cooling of the machine.

The task of the creation of the piston machine is solved in that the piston machine has a crankcase with a cylinder fixed on it, in which a piston with a piston rod is located, a cover arranged on the cylinder, suction and pumping valves, two parallel crankshafts located symmetrically relative to an axis of a cylinder and connected with one another with a possibility of rotation in opposite direction, a traverse connected with the piston rod of the piston, two connecting rods each of which is hingedly connected with one end to a corresponding crankshaft, and hingedly connected with another end to a corresponding end of the traverse, and the piston rod of the piston is connected with a traverse hingedly.

Distinguishing features of the proposed piston machine from the above mentioned closest analog is the configuration of the piston with the inner hollow, and a piston rod with a throughgoing longitudinal axial

passage, connected with an inner hollow of the piston, arrangement of the suction pipe in the crankcase coaxially with the piston rod which extends into the suction pipe with a possibility of reciprocating movement, a connection of the traverse with the piston rod above an entry to the suction pipe, an arrangement of the suction valves on a front wall of the piston, and of pumping valves on the cover.

The configuration of the piston with an inner hollow, the piston rod with a throughgoing longitudinal axial passage connected with the inner hollow of the piston, arrangement of the suction pipe in the crankcase coaxially to the piston rod which extends into the suction pipe with a possibility of a reciprocating movement, the connection of the traverse with the piston rod above the entry to the suction pipe, the arrangement of suction valves on the front wall of the piston, the arrangement of the pumping valves on the cover of the cylinder allows to create a minimal value of a waste space of the piston machine (a minimum volume remaining between the cover and the piston), which leads to an increase of a volume productivity of the piston machine with a creation of a minimal volume of the waste space and to increase through flow cross-sections in the suction and pumping valves due to the arrangement of the suction valves on the front wall of the piston, and the pumping valves already on another location-the cover of the cylinder,

which leads to a reduction of hydraulic losses in the piston machine, and during movement of the piston from an upper position to a lower position provides suction of the working body through the coaxial longitudinal axial passage of the piston rod from the suction pipe, a supply of the working body into the inner hollow of the piston and through the suction valves into the cylinder, and from the cylinder during movement of the piston in opposite direction through the pumping valves the supply to a consumer, leading to a cooling of the piston by the sucked working body and as a result of the whole piston machine. The connection of the traverse with the piston rod above the entry to the suction pipes provides a movement of the piston rod with the piston. The arrangement of the suction valves on the front wall of the piston, and the pumping valves on the cover of the cylinder allows to reduce the volume of the waste space due to the displacement of the suction valves to another location, and increases throughflow cross sections of the suction and pumping valves again due to the location in the same area of a lower number of the suction valves and in the same area of the same number of the pumping valves, which leads to a reduction of hydraulic losses and increase of volume productivity and filling of the cylinder with the working body.

The possibility of forming of the throughgoing longitudinal axial passage of the piston rod with a diffusor from the side of connection

with the inner hollow of the piston and with a conffusor from the side of the entry in a discharge pipe allows to reduce losses of pressure during movement of the working body along the longitudinal axial passage due to provision of minimal speeds of flow of the working body during its entry into the passage of the piston rod and exit from the passage of the piston rod into the inner hollow of the piston and therefore to increase filling of the cylinder with a working body.

It is possible to install the pumping valves on the cover of the cylinder with a possibility of arrangement flush with the surface of the cover from the side of the piston in a closed position, which allows to reduce a volume of a waste space due to the creation of flat surface of the cover from the side of the piston.

It is possible to install suction valves on the front wall of the piston with a possibility of an arrangement flush with a surface of a front wall of the piston in a closed position, which allows to reduce a volume of a waste space due to the creation of a flat surface of the front wall of the piston.

#### Brief Description of the Drawings

Figure 1 shows a longitudinal cross-section of a piston

machine configured as a piston compressor;

Figure 2 shows a view from above on a traverse.

Best Mode of Carrying Out the Invention

A piston machine formed as a piston compressor has a crankcase 1 with a cylinder 2 fixed on it, in which a piston 3 with a piston rod 4 is located, a cover 5 arranged on the cylinder, two parallel crankshafts 6 and 7 with counterweights located symmetrically relative to an axis of the cylinder 2 and connected with one another with a possibility of rotation in opposite direction by means of linked cylindrical gears 8 and 9.

A traverse 29 is connected with the piston rod 4, two connecting rods 10 and 11 each connected with one end hingedly to a corresponding crankshaft 6 or 7, and with another end hingedly connected to a corresponding end of the traverse 29 by means of two ears 25 and 26 with fingers 22 and 23 fixed on them. The piston rod 4 in a zone of connection with the connecting rod has a local square transverse cross-section. The piston rod 4 of the piston 3 is connected with the traverse 29 hingedly by an axle 21.

The piston 3 is configured with an inner hollow 12. The piston rod 4 is configured with a throughgoing longitudinal axial passage 13 connected with the inner hollow 12 of the piston 3. A suction pipe 14 is connected in the crankcase 1 coaxially with the piston rod 4, which extends into the suction pipe 14 through a seal 15 with a possibility of a reciprocating movement along guides. The traverse 29 is connected with the piston rod above the entry to the suction pipe 14 when the piston 3 is located in a lower position. The suction pipes 16 are arranged on the front wall 17 of the piston 3, while the pumping valves 18 are located on the cover 5. The pumping valves 18 on the cover 5 are hydraulically connected to a receiver 19, which in turn is connected with a discharge pipe 20.

Suction valves 16 can be arranged on the front wall 17 of the piston 3 with a possibility of location flush with a surface of the front wall 17 of the piston 3 in a closed position.

The pumping valves 18 can be arranged on the cover 5 with the possibility of location flush with a surface of the cover 5 from the side of the piston 3 in a closed position.

The throughgoing longitudinal axial passage 13 of the piston

rod 4 can be configured with a diffusor 27 from the side of connection with an inner hollow 12 of the piston 3 and with a confusor 28 from the side of entry to the suction pipe 14.

The suction and pumping valves 16 and 18 can be configured as self-acting automatic valves.

The pumping valve 18 can be configured as a control valve.

The suction valves 16 on the front wall 17 of the piston 3 can be configured as conical plates which are tightly seated in conical openings in a front wall 17 and have pins and limiters at the end.

The pumping valves 18 of the color 5 can be configured with guides in form of conical plates which are seated in conical openings in the cover 5 and have pins that are spring biased toward the cover 5.

Analogously, the piston machine can be configured in a variant of a four-cycle internal combustion engine, with replacement of the pumping valves by controlled inlet valves and an additional nozzle for injection of fuel directly into cylinder, arranged on the cover of the cylinder. The piston machine can be also configured as a pump.

The piston pump formed as a piston compressor operates in the following manner. During the rotation of the crankshafts 6 and 7 the piston 3 performs a reciprocating movement in the cylinder 2. During the movement of the piston 3 from an upper position to a lower position, the suction valves 16 on the front wall 17 of the piston 3 during its acceleration downwardly are self-opened due to action of inertia forces, remaining on the limiters, and a suction of a working body takes place through the suction pipe 14 and the throughgoing longitudinal axial passage 13 of the piston rod 4 into the inner hollow 12 of the piston 3 and through the openings in the suction valves 16 into the cylinder 2.

During a further turning of the crankshafts 6 and 7, the piston 3 stops and starts moving upwards, the suction valves 16 are closed due to a creation of acceleration of the piston 3 upwardly. After compression of the working body in the cylinder 2 to a pressure in the receiver 19, a self opening of the pumping valves 18 takes place with overcoming of a force of pressing of their springs, the working body is supplied into the receiver and exits through the outlet pipe 20 to a consumer, and after this the cycle is repeated.

During movement of the working body through the

longitudinal axial passage 13 of the piston rod 4 with the diffusor 27 and confusor 28, losses of pressure of the working body are reduced due to the provision of minimal speeds of flow of the working body during entry into the longitudinal axial passage 13 of the piston rod 4 and exit from it into the hollow of the piston where the pressure is restored.

During carrying out of the process of pumping of the working body in the piston compressor with the pumping valves 18 arranged on the cover 5 with the possibility of location flush with the surface of the cover 5 from the side of the piston 3 in the closed position, the volume of waste space is reduced due to the creation of a flat surface of the cover 5.

During carrying out of the process of pumping of the working body in the piston compressor with the suction valve 16 arranged on the front wall of the piston 3 with the possibility of location flush with the surface of the front wall 17 of the piston 3 in the closed position, a volume of waste space is reduced due to the creation of the flat surface of the front wall of the piston 3.

#### Industrial Applicability

The present invention can be used with maximum success in compressors, pumps and internal combustion engines.